An investigation of a cloud droplet size distribution's dispersion using remotely sensed observations

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The dispersion of a cloud's droplet size distribution is a microphysical property of liquid clouds whose representation in global climate models (GCMs) has likely resulted in an overestimation of cooling from the indirect effect. Studies of dispersion's variability have remained challenging because observational studies have traditionally been limited to *in situ* measurements made by cloud probes on aircraft while profiling clouds. Further, studies focusing on how dispersion varies with other cloud properties, aerosols and atmospheric state parameters have yielded contradicting results.

NASA's Research Scanning Polarimeter (RSP) measures polarized reflectances originating from cloud top, which enable it to remotely measure the dispersion of a cloud's droplet size distribution. Here, we use the RSP's observations of dispersion from the NASA-led Observations of Aerosols Above Clouds and their Interactions (ORALCES) campaign. We present the summary of a study investigating connections and co-variability of dispersion with other cloud properties, cloud types, aerosol loading, precipitation rates and environmental state variables. We assess the impact of these findings on cloud microphysical models and conclude by presenting a realistic parameterization of dispersion derived from these observations which is compatible with a GCM.

We expect that accounting for realistic values of dispersion in a GCM will reduce the amount of reflected shortwave radiation from clouds, which will constructively address the issue of CMIP5 models overestimating cloud reflectance.

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